Involved in the Distribution of Plants, Seeds and Animals; J—Land Utilization and Conservation throughout the Empire; K—The Need for a Coordinated Survey of the Mineral Resources of the Empire; L—Natural Resources of the Empire and the Chemical Industries That Are or Might Be Based on Them; M—Post-War Needs of Fundamental Research; and N—Coordination of Scientific Work within the African Continent.

The Conference in some evening discussions gave consideration and arrived at recommendations in reference to five large topics: Cosmic Rays, Fish Culture, Geochemistry, Hormones, and Fisheries (see Volume II, pages 529–662); the full calendar of the Conference is given on pages 663–677. At the end of each volume there is a complete index for both volumes, comprising about 30 pages. The index gives names of speakers and discussants (not presiding officers and organizing and committee personnel) and of scientific topics of discussion and related entries. A long list of traveling fellowships and scholarships open to students and research workers is provided in Volume II, pages 37–82.

The topic of broadest interest was "morning subject (m)," The Needs of Research in Fundamental Science After the War. The material on this subject for discussion by the delegates consisted of a previously completed report of the Royal Society on Post-War Needs of Fundamental Research, produced by eight committees representing, respectively, Physics, Chemistry, Biology and Biochemistry, Geophysics, Geology, Geography, Meteorology, and Oceanography. The most general recommendations developed were: I) The mechanism for guiding long term research in fundamental science in each country of the Commonwealth should be carefully reviewed in order to foster fertile research work in all important subjects. II) Since needs of the future will require a great increase in the number of scientists, plans for extending basic research in any field should be supported by measures designed, coordinated, and put into operation in the educational system of each country for increasing the number of trained scientists able to carry out such research plans.

This two-volume report is an important and many-sided scientific document. From it one gains an over-all view of the pattern of modern scientific research and development as forming a huge triangle with "university science," "industrial science," and "government science" at its three corners. Science research planners, administrators, financial backers, laboratory workers, educators, and technical and popular science writers will all find the materials in these two volumes worthy of examination and discussion. The report is epochal in the field of assessment, survey, and planning for the advance of science and its applications. It is a model for the preliminary organization and conduct of such conferences, and the Royal Society has again, it seems to the reviewer, demonstrated foresight and outstanding leadership in creating and guiding the Empire Scientific Conference and in making its report available to the public.

WALTER R. MILES

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Liberty Hyde Bailey: a story of American plant sciences. Andrew Denny Rodgers, III. Princeton, N. J.: Princeton Univ. Press, 1949. Pp. 506. (Illustrated.) $7.50.

As these words are written Liberty Hyde Bailey is entering the 92nd year of his life, and is still collecting plants, both living and herbarium specimens, still publishing, still reaching out with his mind, at an age when other men, if they are able to think at all, have mentally "retired," with opinions formed and portals closed to the acquisition of any further and considerable body of knowledge. Not so this dean of American botanists, who once said that he had planned to take 25 years to study the science of botany, 25 to practice it, and 25 to enjoy it. Actually, he has, in each quarter-century since his majority, done all three things at once and is still learning, practising, and enjoying a science which no one in his day ever did more to encourage, broaden, and make vivid.

Many men have gone deeper in their branches of botany; no man in America was ever a better all-around botanist. Bailey is most famous, of course, as an editor, geneticist, and teacher, and as the first American to treat horticulture as a serious science, with the broadest social implications. But beyond all this he is a philosopher—having reached the highest thing any scientist can be—who brings together the varied interests of his own and his contemporaries' minds, and from them evolves not a schematic theory of the world as it ought to be, but an attitude toward the world as it is. A man who can accomplish this, and live, too, a happy and noble personal life like Liberty Hyde Bailey's has indeed fulfilled the high destiny that (we like to think) is the function of a man of science.

All this, and more, much more besides, has been told in *Liberty Hyde Bailey*, by Andrew Denny Rodgers, in the fifth title of his scholarly series of biographies that constitute a history of American botany from the days of Torrey and Mr. Rodgers' ancestor, Sullivant, and the era of systematics and exploration a century ago, down to the present with all its diversities and complexities. Those of us who, like the present reviewer, have read every word so far are grateful to Mr. Rodgers for the precision and breadth of treatment, and the understanding appraisal of the botanists who form the subject of his unusual sort of historical writing. At the same time it must be said that, as writing and as history this is, rather, reference work—the materials for a history. As biography it is a compilation—meticulous, thorough, and lucid—but not living portraiture. Nothing is omitted, nothing is highlighted; a reasonable monotone is the result. By comparison, passages from writings of Liberty Hyde Bailey, as quoted in this book, are so full of natural poetry and vitality of thought and phrase as to make one wish that Professor Bailey would write his own biography, even at the cost of further researches upon palms.

Yet we shall all look forward to further titles from Mr. Rodgers' pen. We hope that he will not only continue with his painstaking researches in the present era, but will carry the history of American botany back to the

days of Linnaeus's American correspondents—Colden, Bartram, and Garden—and that he will take for his models in biographical writing such authors as Boswell, Macaulay, Fiske, and Parkman, whose scholarship never suffered from their artistry.

DONALD CULROSS PEATTIE

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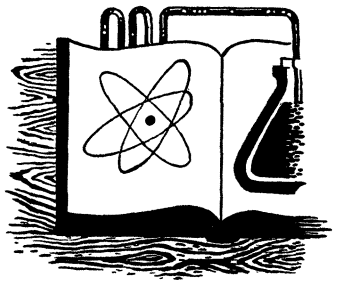

Scientific foundations of vacuum technique. Saul Dushman. New York: John Wiley; London: Chapman & Hall, 1949. Pp. xi + 882. (Illustrated.) $15.00.

This book is a monument to an era just concluded and a marker and a storage depot for the future. The era began with the invention of the condensation pump, and it ended spectacularly when vacuum went to war—high vacuum for radar and the fissioned atom, grand vacuum for magnesium and penicillin. During the intervening 30 years the gas-filled X-ray tube gave place to the Coolidge vacuum tube; the tungsten lamp and electronics came to maturity, and the molecular still was born. A regiment of subsidiary apparatus and measuring instruments sprang up and vacuum plumbing graduated from an unwelcome necessity to a hobby, then to an art, and recently to a science.

In 1922 Dr. Dushman published a little book called *High vacuum* which at once became the guide to a new territory. Shortly afterwards, many larger and more comprehensive books were written, mostly in the same pattern, but none placed the matter more succinctly. It has been evident for 10 years, however, that much new material has accumulated. It has been equally evident that the one man to make the authoritative compilation is Dr. Dushman because, as associate director of the General Electric Laboratories at Schenectady, he has witnessed or himself created nearly all that has transpired.

The *Foundations* is a reference book for scientists and advanced engineers; it does not deal with vacuum in the chemical process industries. The first four chapters—perhaps the best in a very good book—cover the theory of gases (and even the highest vacuum on earth still contains much gas). The next chapters on pumps and gauges are authoritative and comprehensive rather than selective. The later chapters dealing with adsorption, getters, solubility of gases in metals, and diffusion of gas through metals, are encyclopedic. On vapor pressure, the dry or electronic field is fully covered, but pump fluids only meagerly. The references and indexes are splendid. It is difficult to assess the merits of a book that has no rivals; suffice it to say that it stands alone. Practically every laboratory, regardless of its avowed purpose, will find a place for this book.

KENNETH C. D. HICKMAN

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Quantum mechanics. Leonard I. Schiff. New York: McGraw-Hill, 1949. Pp. xii + 404. (Illustrated.) $5.50.

Schiff's new textbook *Quantum mechanics* will be a very great help to anyone who studies this fundamental subject, which by now is taught to every student of physics. There is no other field in physics which poses more and harder problems to the teacher. Explaining the fundamental concepts of quantum mechanics is the most difficult of tasks, and no really clear way of doing it has yet been found. However, every student must not only be acquainted with these fundamental concepts, but also be able to apply them in his research work. Quantum mechanics also uses a great number of very complicated mathematical formalisms to which the student must be introduced. This is the easier part of the course, and too little emphasis is usually given to the exposition of the fundamentals.

The present book is distinguished in this respect from most of the older, widely used textbooks. The first chapter contains a well-presented description of the fundamental concepts of measurement and complementarity. It introduces the reader into the problematics of the subject but does not relieve the more serious student from the study of books like the ones by Dirac or Kramers, and the classical papers of Bohr. The Schroedinger wave equation is introduced in the second chapter by using the experimental relation between frequency and wavelength. This emphasizes the connection with experimental facts, which is sometimes missing in more dogmatic representations. The following chapters are very much along conventional lines, but are written with great care and with emphasis on detailed and elegant derivations. The book differs from the usual introductions into quantum mechanics by a strong emphasis on collision theory. This is a great advantage in view of the increasing application of quantum mechanics to nuclear collision problems.

One notices a change in style beginning with Chapter 9, when the problems of many particles are treated and when radiation is taken into account. Less emphasis is placed on detailed description and the book takes on more of the character of a survey than before. These chapters include discussion of identical particles and the spin of the electron, and a semi-classical treatment of radiation and of the spectra of atoms and molecules. The last three chapters form a separate unit, on the relativistic wave equation, and the quantization of the wave fields, and a short introduction into quantum electrodynamics; they represent, therefore, what is taught in most schools in a separate course on advanced quantum mechanics.

A few details could perhaps be criticized from the point of view of the reviewer, who has probably ac-